





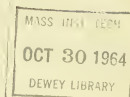
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LECTURE NOTES RELATING TO
A SYSTEMS APPROACH TO MARKETING

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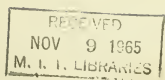
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Lecture Notes Relating to
A SYSTEMS APPROACH TO MARKETING

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Introductory Comments

These lecture notes have been prepared to provide a brief introduction to what we describe as a "systems approach" to marketing decision making. This document summarizing work which we have been doing in attempting to develop a quantitative, systematic way of defining, analyzing, and solving marketing problems is a synopsis of basic ideas presented in A. E. Amstutz' M. I. T. Doctoral Dissertation, A Systems Approach to Marketing. These notes have been prepared to describe the scope of this activity and to provide selected examples of system structure and macro and micro representations of behavior.

Objectives

Our primary objective might be restated as: to develop a quantitative, systems approach to the definition, analysis, and solution of management problems in the marketing area. The sub-goals associated with this major objective might be summarized as follows:

1. Develop a framework within which salient attributes of a general business environment or specific marketing situations can be delineated.
2. Define a series of elements common to a broad range of management problems to serve as the focus of systematic analysis.
3. Create a theoretical structure through which basic elements in the

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environment can be related and the processes through which these elements interact can be described and analyzed.

4. Describe relationships between elements and processes in an explicit manner.

5. Summarize these relationships in a generalized model consisting of a dimensioned system of equations representing a wide range of interaction possibilities.

6. Apply this generalized model to specific management problem situations.

7. Examine the implications of the applied model through the use of computerized simulations.

8. Provide operational solutions for problems of evaluating the accuracy of the resulting simulation through the development of criteria of measurement and validation.

Approach

In discussing this work we will first develop a qualitative description of important factors in the marketing environment. In developing this description we will benefit from your experiences and attempt to focus on problem areas which are of interest to you. This description will serve as the basis of a qualitative but orderly structure within which we may begin to define key elements and processes. As we define these elements, we will develop gross, first approximation, models encompassing them. These models will, of necessity, be based on macro analysis of a limited range of marketing phenomena. However, they will serve to demonstrate how models providing more complete descriptions of actions within each sector of the marketing system can be developed.

Following development of a representative sector model, the synthesis of a representation of the total marketing environment formed by combining sector models

in a single simulation will be considered.

If time permits, application of a large scale simulation to the analysis of behavior within particular product markets will be discussed in context of questions of validation and a comparison of simulation performance with data obtained from the actual business environment will be made.

Perspective

We will examine the marketing environment as seen through the eyes of a manager who is faced with the problems of marketing his product or service to the industrial purchaser or ultimate consumer.

While at times we may be interested in questions of optimal allocation and ideal strategy, we will always be concerned with developing a framework within which the problem of generating sales at profitable levels under conditions which will permit short run solvency and long term capital appreciation may be analyzed.

In structuring the marketing world we will attempt to establish a framework of analysis which will support investigations leading to more effective manipulation of factors within the marketing environment. Our tests of relevancy will be pragmatic. We must isolate and describe elements and processes which bear directly on the problems of producing, distributing, promoting, and selling products and services.

This perspective will influence our orientation toward marketing related processes. We may view promotion as communication of specific product attributes and appeals to the ultimate consumer with the objective of convincing him of his immediate and/or continuing need for our product or service. We may view distributors and wholesalers as transfer agents who convey our product and, at times, information to the consumer. The salesman may be viewed as an order

taker who sometimes serves as an information channel. The government may be examined in terms of the controls and constraints which it imposes. Competition within the marketing environment will be considered in terms of the management decisions through which competitive strategy is developed and implemented.

We cannot afford the luxury of taking a detached and disinterested position. We are concerned with decisions. Analysis is not an end but merely a means to better decision making in a complex environment. In a similar sense research is a means through which information about the environment may be collected, structured, and communicated with varying degrees of accuracy to those who use it as a basis for developing implicit or explicit models against which they test alternatives when making decisions. When considering the research function as part of the total management system, we will be concerned with the relationship of research to decisions and the contribution which a particular research effort can make by providing data in a form which will directly affect specific decisions and actions.

The purchaser is the *raison d'être* of the system with which we are working. The ultimate focus of our study will be the purchase decision. In describing, modeling, and analyzing processes and interactions within the marketing system, our final objective is to relate all elements in terms of their effect on the outcome of this decision.

Qualitative Description of Marketing

Markets for goods, services, capital, and ideas can be described in different ways and depicted in sometimes conflicting word pictures. In beginning our discussion of marketing relationships we would like to introduce a slightly different perspective on the actions and relationships with which you are already familiar. We would like to view the marketing world through the eyes of a manufacturer of a consumer or industrial product or service who is faced with the basic problem of selling. Taking this view, we might think of the market as a network from which the producer attempts to obtain a particular set of responses. He is able to manipulate certain passive elements within this network and to provide signals to which the active elements may respond. Some information about the state and response of particular elements can be obtained directly from the network elements. However, most useful and general information relating to the affect of interactions of elements within the system and the total system response to a particular input must be imputed from an analysis of the characteristics of the output generated by the system in response to a given input.

This qualitative definition of a marketing system is a start in removing many of the ambiguities which create problems in marketing analysis. Before elaboration of this structure we must define terms and develop specific and unambiguous ways of describing the actors and the interactions between them.

The system may be specified in terms of two kinds of actions -- observable and implied, eight active elements, three passive elements, and three elements of flow.

Observable Actions

Observable actions within the marketing environment include all events which may be directly verified by observation. These include actions associated with

the distribution of physical goods, the communication of information, the implementation of pricing policies, generation of orders by wholesalers and distributors, and product or service consumption.

Implied Actions

Included in implied actions are the equally important but not directly observed processes which, it is reasoned, must underlie and support the observable processes. Implied processes involve intermediate variables which must be detected, defined, and measured if the existence of implied actions is to be given empirical verification. Implied processes include: exposure and response to advertising, establishment of effective motivation for sales forces, and the development of and change in consumer knowledge and attitude.

Eight Active Elements

The active elements in the marketing network are human and, as such, can originate signals as well as react to signals received from other active elements within the network. The eight active elements are: (1) the producer; (2) his competitors; (3) distributors and wholesalers; (4) selling agents (e.g., salesmen); (5) retailers; (6) consumers; (7) government; and (8) research agents.

Each of the active elements may be described by characteristic functions which are categorized in terms of the inputs the element receives, the variations in inputs to which the element is sensitive, the output which the element is capable of generating, and the correlations, if any, between specific input and output combinations.

Three Elements of Flow

The three elements of flow are the means of interaction between the active elements. These are the elements which successful management is able to manipulate to achieve desired objectives. The elements of flow are unable to either

initiate or respond to signals. They are the media through which signals are transmitted -- the means of energy transfer analogous to the electrons which flow in an electronic network. The elements of flow, all of which are manipulated by the active elements, may be defined as: (1) product, (2) information, (3) capital.

Passive Elements

Passive elements may be described as characteristic of the channels through which elements of flow move in travelling between active elements. Passive elements affect the signals (elements of flow) moving in the channel with which they are associated. However, passive elements cannot originate signals or affect active elements directly. Three types of passive elements may be defined. These are: (1) time delays which affect the movement of elements of flow between active elements; (2) dissipators which reduce the magnitude of elements of flow as they are transmitted between active elements; and (3) storage elements which accumulate backlogs of elements of flow.

Summary

This qualitative organization of the marketing system may be summarized for the consumer marketing case with reference to Figure 1 which illustrates interactions between seven of the eight suggested active elements. As indicated by the lines representing flow of information, each element generates and responds to signals (information) from other active elements.

Two of the three suggested elements of flow are represented in Figure 1. These are product, represented by a solid line, and information, represented by a dashed line. As indicated earlier, elements of flow are controlled by the active elements.

The passive elements are not explicitly represented in the drawing, however, a brief description of the flow of product from the producer to the distributor in the situation illustrated may serve to specify the effect of passive elements.

The effect of a time delay in the flow of goods from the producer to the distributor is self-evident. Time delays are involved in the processing of the distributor order by the producer, in getting the product from the warehouse into transportation, in the transporting of product to the distributor, and in product handling at the distributor level.

Dissipation is a somewhat more elusive concept in the context of product flow, although it will be highly important when dealing with information flow. In the case of product flow, dissipation occurs when product is lost, spoiled, or damaged while in transit from the producer to the distributor.

The concept of a storage element should be self-evident in the case of product flow. The product is stored in inventory at the producer, it is effectively stored in transit while being transferred from the producer to the distributor and, once it reaches the distributor, it is stored in his inventory until shipped to the retailer.

As a further example of the way in which our qualitative structure influences our description of processes within the marketing environment, we might consider again the flow of information from the producer to the consumer. Some information is transmitted directly from the producer to the consumer (assuming that advertising accurately communicates the basic ideas which the producer wishes to transmit), other messages travel to the consumer after being filtered (delayed and perhaps dissipated) through the distributor. In the first instance, we are concerned with the consumer's response to signals received directly from the producer. In the second we will be concerned with the response of distributors

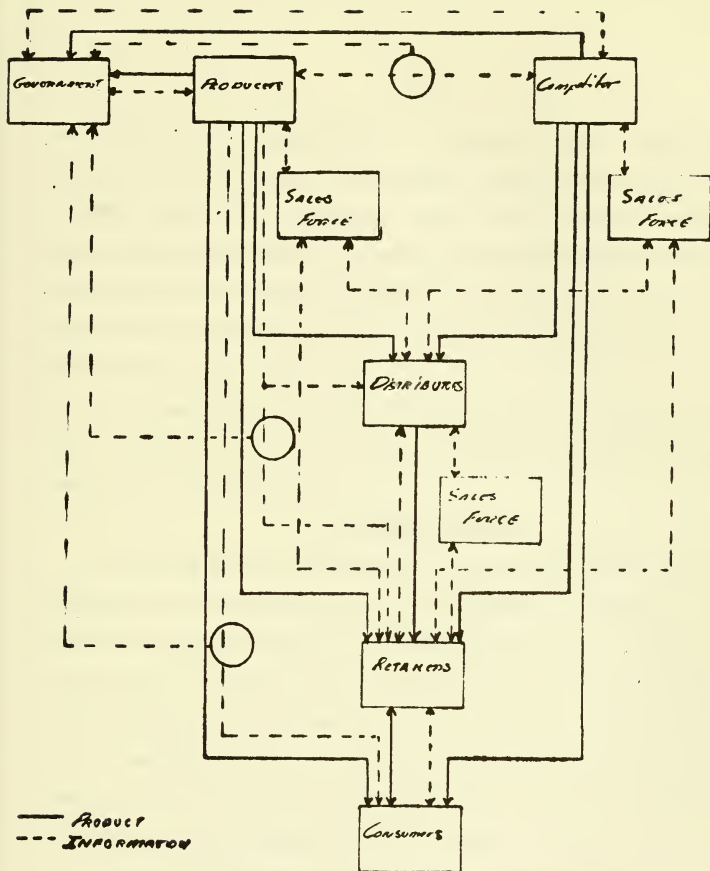


FIGURE 1 - Macro Flow Chart Example

and his sales force to the producer's information, the way in which these active elements modify the signal as they transfer to the consumer, and the consumer's response to the signal in the form in which it is ultimately transferred by the distributor and his salesmen. In short, we are concerned with transfer functions which describe the response and transfer characteristics of each of the active elements within the marketing system to the inputs from every other active element within that system.

The foregoing section provided the skeleton of the structure we propose. In the following section we will attempt to provide the detail which gives meaning to the total structure.

A. Elements of Flow

In the most general sense elements of flow are that which is flowing through the channels of the marketing system. Three classes of elements of flow which have been delineated as product, information, and capital. Elements of flow are expressed in terms of a rate of flow over a given period of time and, as such, are measured in units per time period. Processes involving elements of flow will be considered at the point of origin where the element enters a particular channel, within the channel as the element flows through it, and at the point of termination where the element leaves the channel.

Although the names which I have given the elements of flow are generally meaningful, in order to avoid future ambiguity it may be useful to establish very specific definitions for each.

Product

Two major classifications of product flow are of importance within the marketing system. At the manufacturing level there is the flow of raw material which is converted to work in process and finished goods. Since we are primarily

concerned with the marketing activities of the firm we will not give consideration to subclassifications within the raw material product category. Our only concern with raw material will be in context of the affect of raw material scarcity on production scheduling and ability to supply finished goods.

Outside of manufacturing and throughout the entire distribution system there are flows of finished goods of three major types. First, there are salable items intended for ultimate consumption which constitute the major portion of product. The second classification of finished goods includes all types of samples -- all product distributed to the trade for display and promotional purposes for which the manufacturer receives no payment or less than normal payment, and product distributed to potential consumers as part of introductory promotional programs. The third finished goods classification is returns. Returns include all product returned to the retailer, distributor, or manufacturer, whether for repair or replacement. Many differentiating characteristics may be noted within each of the three finished goods subdivisions, e.g., distinctions based on specific brands, models, product or package size and color.

In outline form our classification of product as an element of flow may be summarized as:

- I - Classifications
 - A - Raw Materials
 - B - Finished Goods
 - 1 - Salable Items
 - 2 - Samples
 - 3 - Returns
- II - Attributes
 - A - Raw Material Attributes
 - 1 - Scarcity of Material
 - 2 - Price Elasticity of Supply
 - B - Finished Goods Attributes
 - 1 - Brand
 - 2 - Model
 - 3 - Size

Specification 1 -- Definition of Product as an Element of Flow
Information

In examining the flow of information within the marketing system three classifications of communication -- promotion, operating communications, and word-of-mouth communication -- will be distinguished. Promotion may originate at the producer or retailer level and is communicated through formal media channels to the entire population or to a segment of the population. Operating information may originate at the producer, distributor, salesman or retailer level and is transmitted formally but privately between elements in the distribution system. The third type of information flow, word-of-mouth communication, is originated by and transmitted to consumers. Each instance of word-of-mouth communication is thus an informal and private matter. However, the phenomenon of word-of-mouth communication is noted throughout the population.

The term "promotion" encompasses all communication relating to product characteristics and/or product-associated appeals directed through media or trade channels to the population at large or selected segments of that population. In conjunction with the development of a media model below considerable attention will be given to description of the content of this type of information flow. Three subcategories will, however, be sufficient for purposes of classification of promotion. These are: (1) media advertising, (2) point-of-sale advertising, and (3) selling presentations.

Media advertising is formal communication through radio, television, direct mail, outdoor, and print media. Point-of-sale promotion includes all formal information flow to the consumer through brochures, broadsides, placards, and displays at point of sale. Selling presentations include all person to person information flow from those interested in the sale of a product to those who might

potentially purchase same. Although the content of a given point-of-sale communication and selling presentation may be synonymous, for purposes of this discussion, information flows involving person to person communication will be distinguished from those involving a formal media channel.

Three classes of operating information will be noted. These are: (1) orders and confirmations, (2) policy communiques, and (3) reports. Orders and confirmations include orders, notifications of order receipt, back orders, invoices, and other product related communications. Policy communiques are defined to be the information flow associated with communication from one active element to another in which the first element specifies an action which he desires the second element to take. Policy communiques thus include a wide range of communications between the producer and the trade in which pricing, ordering, and other aspects of the business relationship are discussed. Under the subheading "reports" we will include all information flow between elements specifying present or past conditions. The reports classification thus includes all information flow from the operating sectors in the course of research.

The word-of-mouth classification encompasses all product related communication between consumers. From a content standpoint this type of information flow may not appear to be substantially different from certain forms of promotional information flow. However, since word-of-mouth communication is originated by an individual consumer and transmitted at the personal level, it is important that it be distinguished from the other types of information flow.

In order to fully specify a particular type of information flow we must ultimately be concerned with the content of communication, i.e., the intelligence

conveyed by the flow of information. Detailed communication models representing the generation and transmission of and response to communication will be developed below. For purposes of definition it is sufficient to note that in promotional and word-of-mouth communication, content relating to product associated appeals must be distinguished from product characteristic and brand name related information flow.

Two types of communication content must be distinguished when dealing with operating communication. Content relating to orders and confirmation as well as some reports will relate to finished goods and, as such, must be described in terms of the attributes of finished goods specified earlier -- brand, model, and size. In the case of policy communiques and certain other reports relating to non-product information, communication content will be specified in terms of its relationship to price, margins, allowances, direct compensation, or conditions of distribution.

For summary purposes an outline of the basic classification structure for information as an element of flow is presented in specification 2 below.

- I - Classifications
 - A - Promotional
 - 1 - Media Advertising
 - 2 - Point-of-Sale Advertising
 - 3 - Sales Presentations
 - B - Operating
 - 1 - Orders and Confirmations
 - 2 - Policy Communiques
 - 3 - Reports
 - C - Word-of-Mouth
- II - Specification of Content
 - A - Content of Orders, Confirmations, and Some Reports
 - 1 - Brand
 - 2 - Model
 - 3 - Size
 - 4 - Quantity
 - B - Content of Policy Communiques and Some Reports
 - 1 - Price
 - 2 - Margins and Allowances
 - 3 - Direct Compensation
 - 4 - Conditions of Distribution

- C - Content of Promotional and Word-of-Mouth
 - 1 - Product-Related Appeals
 - 2 - Product Characteristics
 - 3 - Brand Name Associations

Specification 2 -- Definition of Information as an Element of Flow

Capital

In a representation of total corporate activity, capital would be of great importance as an element of flow and would require categorization into many differential sub-classifications. However, within the marketing environment a narrowly defined concept of capital as an element of flow will serve adequately. In considering interactions within the marketing environment, only two forms of capital or value which might be described as cash and discountable paper are of importance.

Cash is of importance primarily in the context of payments for goods received, for advertising allowances and other promotional expenditures, and for direct compensation in the form of salaries, commissions, or push money. Discountable paper comes into consideration primarily in the context of accounts receivable and orders.

It should be noted that orders appear as sub-classifications of two elements of flow. They are of interest as a form of operating information and as a form of value or capital. Thus dual appearance does not indicate double counting. The information content of an order is simply being distinguished from its value content. On the one hand, an order conveys information regarding a condition of demand for a specified quantity of a particular brand - size - model of product at a given place in the marketing system. On the other hand, an order is indicative of value to be received and, as such, is an element in the financial equation within the marketing system. This distinction may appear pedantic. However, as

equations representing the specific impact of information and capital are developed, the importance of recognizing these two functions of a single order will become apparent.

Two specifications of content serve to describe capital flow. These are dollars and dollar value, which are applicable to cash and discountable paper flows respectively.

In summary, the basic characteristics of capital as an element of flow are:

- I - Classifications
 - A - Cash
 - B - Discountable Paper
- II - Specification of Content
 - A - Dollars
 - B - Dollar Value

Specification 3 -- Definition of Capital as an Element of Flow

B. Passive Elements

1. General Definition of Passive Elements

The three passive elements, time delays, backlogs, and dissipators involve concepts which are useful in describing large classes of electro-mechanical, man-machine, and human systems. For this reason it may be useful to examine the general characteristics of these elements and to establish general definitions for them before turning to the specific problem at hand -- the problem of describing behavior within a marketing system.

a. Time Delays -- A General Definition

Time delays refer to the time lapse between initiation and termination of a specific process. In the case of channels of flow, time delays may indicate the length of time required for an element of flow to move through the channel from point of origin to point of termination. Where processes are involved, delays may refer to the time required for completion of a particular process.

b. Backlogs -- A General Definition

Backlogs are storage elements in which units of element of flow may accumulate. Backlogs may contain an actual accumulation of physical items, such as product, or a hypothetical accumulation of information, momentum, or energy.

In dealing with mathematical representations of interactions within various systems, it is useful to distinguish between two types of backlog, those associated with processes involving a delay and those independently controlled by an active element.

Delay associated backlogs are inherent in a process involving time delays. For example, we might be concerned with a process in which goods are transferred from one point to another through a transportation system with an inherent delay of one week. At any point in time this transportation channel may be described in part as a backlog of all goods which have been shipped during the preceding seven days. This accumulation of goods within the transportation system is a backlog associated with the seven day transportation delay. The extent of this backlog at any point in time is a function of the time delay associated with the transfer process and the inputs to the process.

The extent of an independent backlog can be controlled by one or more active elements. For example, in the case of a backlog of accumulated cash under the control of a given active element, it is a simple matter for that element to completely deplete the entire cash backlog at one point in time without waiting for a process to run its course. The size of the backlog is, at all times, determined by the active element.

Conceptually and mathematically there is no difference between a delay associated backlog and an independent backlog. However, from an operating standpoint, there is a major distinction. In the case of a delay associated

backlog, the active elements are, at any point in time, stuck with the situation. They can do nothing to modify the backlog without changing the entire process with which the backlog is associated. On the other hand, in the case of the independent backlog, the active element can vary the extent of the backlog (at least insofar as depletion is concerned) at will. Increasing the size of the backlog may involve inputs which are related to processes outside the control of the active element and, as such, introduce some of the same problems associated with attempting to change a delay associated backlog. However, at least theoretically, the independent backlog is under the direct control of the active element, while the delay associated backlog involves on-going processes outside the realm of his immediate control.

The magnitude of a backlog is expressed and measured in units. When physical items are involved, the measurement of the contents of a backlog is, at least conceptually, a trivial problem. Backlogs of information and energy can be expressed mathematically in a manner identical to the representation of a physical backlog. However, measurement of the contents of an information backlog involves a new set of problems. Objective measurement of the information or knowledge existing in a population or individual at a given point in time involves something more than counting boxes. This difficulty should be kept in mind when defining backlogs which may make sense conceptually but are extremely difficult to verify with real world data.

c. Dissipators -- A General Definition

Dissipators are elements which account for the loss of units of elements of flow within the system. When a process is non-conservative -- when we end up with less at the end of the process than we had at the beginning -- we must account for the flow of that which is lost out of the system. This is the role

of the dissipator.

As with backlogs, dissipators may be encountered in two mathematically identical but operationally different contexts. The delay associated dissipator is a fact of life which the active element must accept with little or no choice. The independent dissipator is, on the other hand, under an actor's control.

Dissipation is measured in terms of the rate of flow. The dissipator may be viewed as a subsidiary channel branching off from a main channel of flow and leading out of the system. The comments made above with reference to elements of flow in channels within the system apply equally to the flow of elements of flow out of the system through the dissipator.

2. General Form of Graphic Representation

The three passive elements will be represented graphically according to a set of conventions summarized in Figure 2 -- General Form of Representation for Elements of Flow. The following comments refer to Figure 2.

Rates of flow into and out of a given channel are indicated by diamond shaped inserts at the beginning and end of the channel. Delays are represented by an angular wedge intersecting a channel of flow. Backlogs are indicated by a rectangular enclosure. Backlogs associated with a delay are appended to the wedge representing the delay, while independent backlogs intersect the channel of flow with which they are associated.

The set of four elements at the top of Figure 2 represent a conservative channel consisting of an input rate, a delay with associated backlog and an output rate. The channel is conservative in that the element of flow in that channel is totally conserved. Everything that flows into the channel as part of the input rate will eventually flow out of the channel as part of the output

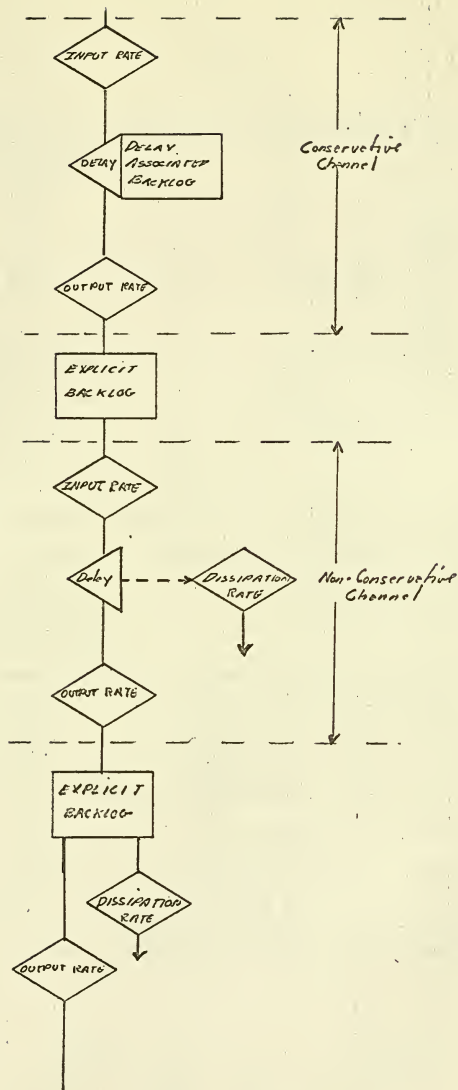


FIGURE 4-2 -- General Form of Representation for Elements of Flow.

rate. The integral over time of the input rate is equal to the integral over the same period of the output rate.

Equation 1

$$\int_t \text{Input (t)} \left| \begin{array}{l} +00 \\ -0 \end{array} \right. = \int_t \text{Output(t)} \left| \begin{array}{l} +00 \\ -0 \end{array} \right.$$

The rectangle located in the channel following the output rate from the conservative channel represents an explicit backlog. The level of this backlog is determined by summing the output from the conservative channel less the input to the non-conservative channel over time.

In most situations with which we will be concerned either the input rate, the output rate, or both will be controlled by a particular active element which, through controlling the input or output rate, attempts to maintain a desired level in the explicit backlog.

The four elements following the explicit backlog in Figure 2 represent a non-conservative channel in which that which is delayed is dissipated. Under these circumstances the sum of the input rate over time is not equal to the sum of the output rate over time, and the dissipation rate must be taken into consideration in order to account for all elements of flow which enter the channel. Since the dissipation rate controls flow into a channel external to the system with which we are dealing, it represents a loss to our system.

Equation 2 provides a mathematical statement of the conditions of this channel.

Equation 2

$$\int_t \text{Input (t)} \left| \begin{array}{l} +00 \\ -0 \end{array} \right. = \int_t \text{Output (t)} \left| \begin{array}{l} +00 \\ -0 \end{array} \right. + \int_t \text{Dissipation} \left| \begin{array}{l} +00 \\ -0 \end{array} \right.$$

Most situations encountered in the marketing world can be described by either a conservative channel or a combination of conservative and non-conservative channels. We will seldom encounter a situation involving a totally dissipative process.

The three elements following the non-conservative channel represent a directly controlled as opposed to delay associated dissipation rate. In this situation the magnitude of an explicit backlog is determined by the rate of flow into the backlog, the output rate and a dissipation rate. In most situations in which a combination of this type is encountered, both the output rate and dissipation rate will be under the control of the same active element. (Refer to Figure 2 -- General Form of Representation for Elements of Flow.)

3. Specific Definitions

In context of the marketing oriented objectives of this study each of the passive elements discussed above can be defined in a more limited sense.

a. Time Delays -- Specific Definitions

For our purposes a time delay will be defined as the number of time periods (DT) separating the present time (t_o) and the reference time (t_r).

Equation 3

$$\text{Delay} = t_o - t_r = D \cdot DT$$

DT is the smallest discrete time interval considered in the system being examined. D is an integer specifying the number of periods of delay.

In our previous discussion we have made reference to only one type of delay, namely that involved in a process. We should note that a second type of delay, a calculation delay, will be encountered as we begin developing formulations. However its significance, relating to discrete approximations to continuous

processes, is largely mathematical. Calculation delays are nominal delays, usually equal to one DT, inherent in the use of difference equations. Process delays will, in all instances, be greater than DT. Due to mathematical considerations to be discussed later, process delays will in fact be equal to or greater than six times DT.

b. Backlog -- A Specific Definition

The magnitude of a particular backlog is defined as the cumulative difference between the sum of all input and output rates into and out of that backlog. Since the backlog is measured in units, its formulation involves the conversion of rates which are measured in units per time to units through multiplication by the time period base.

Equation 4

$$\text{Backlog (t)} = \text{Backlog (t-1)} + \left[\sum_{n=1}^N \text{Input (n, t-1)} - \sum_{m=1}^M \text{Output (m, t-1)} \right] \cdot \text{DT}$$

Where: Backlog (t) = Value of Backlog at the present time -- t

Backlog (t) = Value of Backlog at beginning of immediately preceding time period -- t-1

$$t-1 = t - \text{DT}$$

Input (n, t-1) = Value of nth input rate during immediately preceding time period

Output (n, t-1) = Value of mth output rate during immediately preceding time period

The distinction between implicit and explicit backlogs discussed in context of the general definition is obvious in the marketing situations to be modeled in this study.

Implicit (delay associated) backlogs contain units undergoing processing in a process which involves a delay. For example, implicit backlogs will be encoun-

tered in the manufacturing process as backlogs of work in process resulting from production line delays in excess of DT. An implicit backlog of goods in transit will result from shipping processes involving a transportation delay greater than DT. Clerical processing of orders will produce an implicit backlog of orders in process in situations where clerical delays exceed one DT.

Explicit backlogs will contain units being stored by an active element. Probably the best example of an explicit backlog is the inventory of physical product maintained by the manufacturer, distributor, retailer, and, in some situations, the consumer. In each instance the magnitude of the backlog -- the size of the inventory -- is explicitly determined by the active element maintaining that backlog.

c. Dissipators -- Specific Definition

Dissipators may be defined as the rate of flow equivalent to the negative difference between the input and output to a channel which is not conservative.

Our definition of a dissipator can be summarized in equation form as follows:

Equation 5

$$\text{Dissipation (t)} = \sum_{n=1}^N \text{Input (n, t)} - \sum_{m=1}^M \text{Output (m, t)} - \frac{[\text{Backlog(t)} - \text{Backlog(t-1)}]}{DT}$$

$$\text{Where: } \sum_{n=1}^N \text{Input (n, t)} \geq \sum_{m=1}^M \text{Output (m, t)} - \frac{[\text{Backlog(t)} - \text{Backlog(t-1)}]}{DT}$$

The dissipation at time t is a rate expressed in units per time. Thus, the equation is dimensionally correct with respect to the input and output rate. However, the backlog factor must be corrected by dividing the unit backlog terms by a time period term in order to obtain the required units-per-time-period dimensionality.

As noted earlier, we will seldom encounter a situation of pure dissipation in which all elements of flow through a channel are totally dissipated. Rather

we will be dealing with channels in which partial dissipation occurs while some portion of the elements of flow is conserved. In the case of the totally non-conservative channel represented in Figure 2, the backlog term would be zero, and any difference between input and output at a given point in time would be dissipated.

As in the backlog case, the two classes of dissipation noted previously will be easily distinguished in practice. Implicit (delay associated) dissipators expressing the rate of unit loss in a non-conservative delay system will be required to describe phenomena such as information loss in inefficient media transmission. As further examples of the delay associated dissipator, we might consider the process of forgetting or the process of product loss through spoilage. In either case the passage of time results in loss. Individuals forget information. Physical product deteriorates. In both cases the total useable content of the system is reduced.

Explicit dissipators indicating unit loss as a result of actions taken by an active element will be of importance in describing phenomena such as sample product or point-of-sale material loss due to the retailer's decision to reject such material.

1. Active Elements -- A General Definition

The most basic common characteristic of all eight active elements is that they are human. As such, each active element is able to react to actions by and respond to communications from other active elements in rational and/or emotional ways. All of the active elements are also able to take actions and originate communications to which other active elements will react and respond as the cycle of interaction continues ad nauseum. Our objective at this time is to describe this milieu in terms of a limited structure of decision capabilities, actions,

responses, and reactions. We must define each of these highly complex factors in greatly simplified terms. If, at a later point in time, our initial description appears too simple, the definitions may be expanded to include previously ignored attributes. However, until the need for such expansion becomes obvious, we will limit our concept of that which constitutes a manufacturer, distributor, retailer, salesman, consumer, research staff, and government to the specific definitions established below.

Six major characteristics appear to constitute the most relevant descriptors of active elements. For example active elements are able to:

1. Control rates of flow through certain channels
2. Control the size of certain backlogs
3. Control the extent of certain delays
4. Respond to channel content originated by other active elements
5. Modify existing content in some channels
6. Originate new content as input to certain channels

a. Specific Definition of the Producer (Marketing Decision Maker)

In developing a specific and limiting definition of the producer or marketing decision maker, we must examine each activities in which he engages in the context of one of the six major classifications defined above. We must decide which rates of flow, backlogs, delays, responses to channel content, content modification, and content origination controlled by the producer are of sufficient importance to be included in our definition.

Since we take a simplified view of the manufacturing process, only three flows are controlled by the producer in producing a product. These are (1) the flow of orders for raw materials from the producer to his suppliers, (2) the flow of payments for raw materials received and, (3) the flow of raw materials into and finished goods out of production.

The rate of product flow from the producer to distribution channels is controlled by the marketing decision maker who establishes a rate of flow of finished goods shipments to the distributor and/or retailers based on orders received from these sectors. Paralleling the goods flow channel, are capital and information channels through which the producer controls the rate of flow of invoicing and billing to the distribution channel.

The producer controls information flow in three formal promotional channels. The first communicates content directly to the consumer through media advertising. The second communicates to the consumer indirectly through elements in the distribution channel, and the third communicates only to active elements engaged in distribution and selling activities.

Backlogs controlled by the producer are closely related to the flows discussed above. Basic production related backlogs include the raw material inventory, the finished goods inventory and a backlog of goods in process. The flow of payments to suppliers is a function of backlogs of cash and accounts payable, controlled by the producer. We should note that although the producer maintains several other backlogs, including those related to accounts receivable, he is not in a position to directly control the magnitude of these backlogs in the sense that he controls, assuming solvency, his backlogs of cash and accounts payable. The producer's handling of orders from the distributors and/or retailers through whom he sells involves backlogs of orders-in-process and back orders. Allocation of funds and commitments to promotional campaigns may be thought of as constituting a backlog of advertising work-in-process relating to the flow of promotion from the producer.

The producer directly controls the delays associated with the scheduling of production and the actual manufacturing process. Production scheduling delays

determine the sensitivity of production scheduling to changes in demand for the producer's product as reflected in orders, while manufacturing process delays reflect the overall efficiency of the production process. In a similar manner delays associated with shipping and order handling processes indicate the relative efficiency of these activities. Within context of a model based on the previously noted backlog of advertising work in process, delays associated with communication scheduling are analogous to those involved in the production process. Delays associated with the billing process influence the aging of accounts receivable. A series of response associated delays determine the sensitivity of the producer's response to information regarding competitive activities. Each of these delays are associated with processes under the control of the producer and, within the limits of reasonable cost alternatives, can be varied and controlled by him.

The producer responds to information received directly and indirectly from competitors, the distribution channel, and consumers. His responses to communication content regarding competitors can be categorized in terms of the five areas of competitive activity about which information may be transmitted to him. These are: (1) the sales of competitors, (2) promotional activities of competitors, (3) competitive product features, (4) the pricing policies of competitors, and (5) the distribution policies of competitors. Information content relating to distribution policies includes references to competitors' choice of distributors, margins and allowances, use of direct compensation including push money, missionary selling activities, etc. The terms "pricing policy" and "promotion" as used in the above context should be interpreted broadly as well.

The producer's response to communication from the distribution channel can also be categorized in terms of the information to which he is responding. In the case of the distribution channel this would include information regarding the

rates of sales and orders, pricing action, selling effort, inventory levels, and handling of competitive products.

The content of information from the consumer sector to the producer can be classified under three major headings. These are: (1) information relating to consumer product characteristic preferences, (2) consumer purchases, and (3) consumer responses to promotion. Some of this information is transmitted to the producer directly by the consumer. However the major portion of this information flow is indirect, coming through research agents. The term "consumer product characteristic preferences" should be interpreted broadly to include expected product life and price as well as all physical product attributes.

The producer originates content for channels of communication going to all of the other active elements within the marketing system. The content includes pricing policy, distribution policy, and sales policy.

Still another class of communication content relates to the ordering policies which the producer hopes to have the distributor and/or retailer employ when ordering product. Ordering policies and pricing policies are, of course, often interrelated because of price advantages accruing to those who follow the desired ordering policies. However, for purposes of this enumeration we will consider them as separate and distinct information content.

Communication from the producer to the distributor, retailer, and sales force regarding compensation in form of salaries, commissions, and push money constitutes a further classification of content.

Finally, the producer provides content for promotional communication. Later, in the development of a media model, we will be concerned with detailed specification of the content of promotion. For the moment, we will classify promotional content in terms of the product related appeals, product characteristics,

and brand name. The producer is responsible for originating this content in the case of all national promotion and, through newspaper mats and prepared content for other media, much of the local retailer promotion as well.

Within the scope of our view of the producer, he does not act to modify existing content in any channels which go beyond the confines of his immediate operations. For this reason we will not specify any actions for him under a category based on the fifth point in the general definition of active elements.

The above definition of a producer is summarized in outline form as follows:

Specification 4 -- Definition of the Producer

1 - Flows Controlled

- a - Orders for Raw Materials
- b - Payments for Raw Materials
- c - Finished Goods Production
- d - Finished Goods Shipments to Distributor and/or Retailer
- e - Invoicing and Billing Distribution Channel
- f - Promotional Communication
 - 1 - Direct to Consumer
 - 2 - To Consumer via Distribution Channel
 - 3 - To Trade

2 - Backlogs Controlled

- a - Raw Material Inventory
- b - Finished Goods Inventory
- c - Goods in Process
- d - Cash
- e - Accounts Payable
- f - Orders in Process
- g - Back Orders
- h - Advertising Work in Process

3 - Delays Controlled

- a - Production Scheduling
- b - Manufacturing Process
- c - Order Handling
- d - Shipping
- e - Communication Scheduling
- f - Billing
- g - Response Associated

- 4 - Responses to Channel Content
 - a - Relating to Competitive Actions
 - 1 - Sales
 - 2 - Promotion
 - 3 - Product Features
 - 4 - Pricing Policies
 - 5 - Distribution Policies
 - b - Relating to Distribution Channels
 - 1 - Sales and Orders
 - 2 - Pricing
 - 3 - Selling Effort
 - 4 - Inventory Positions
 - 5 - Competitive Product Handling
 - c - Relating to Consumers
 - 1 - Product Characteristic Preferences
 - 2 - Purchases
 - 3 - Responses to Promotion
- 5 - Channel Content Modified
None
- 6 - Channel Content Originated
 - a - Relating to Pricing Policy
 - b - Relating to Distribution Policy
 - c - Relating to Sales Force Policy
 - d - Relating to Ordering Policy
 - e - Relating to Direct Compensation
 - f - Relating to Promotion

b. A Specific Definition of the Distributor or Wholesaler

For our purposes, the distributor and wholesaler are two sub-sets of a single active element. The primary function of either the distributor or the wholesaler is expediting the flow of physical goods from the producer to the retailer and/or ultimate consumer. In developing a flow chart of the transfer of physical goods, the distributor appears as a combination of backlogs, delays and response elements located between the producer and the outlets he is attempting to reach.

In a similar fashion the distributor stands midway between the producer and the retailer or consumer in the personal contact communication channel. If the producer wishes to make use of trade channels as a means of communicating

information about his product, he must deal with numerous frustrations associated with the delays, dissipations, and random noise generation introduced in the communication channel by the distributor. Although it is possible for the distributor to transmit information received from the producer directly to the retailer or consumer without substantial modification, the incidence of this occurrence is likely to be small. In most situations, the distributor represents an inefficient channel of direct communication and in all situations the active element which we describe as the distributor is in complete control of the flow of promotional communication which the producer attempts to transmit through him.

Since the distributor or wholesaler is a link in the flow of funds it is evident that he is able to control flows of both information and value relating to the invoicing of retailers and payments to producers. Depending upon the actual distribution function performed by this actor, he may serve only as agent to the producer and not take physical possession of the goods, receive goods on consignment, or purchase and maintain inventories of goods for resale. In any event he controls appropriate flows of value and order related information.

Three basic classes of backlogs are controlled by the distributor in the course of maintaining the flows of information, product, and value noted above. There are (1) backlogs of product in the form of finished goods inventory; (2) backlogs of orders being processed at the distributor level, and (3) backlogs of unfilled orders awaiting action. The extent of the backlog of finished goods at the distributor level is a function of the distributor's ordering decisions which, in turn, are functions of actual and expected values of other parameters within the distribution system.

Orders in process depend largely on the efficiency of the clerical operations at the distributor level and the rate of order receipt from the retail level. The

backlog of unfilled orders maintained by the distributor is directly under his control in the sense that it is a function of finished goods available for shipment in inventory. However, control of this backlog is basically indirect and more analogous to the control of the backlog of orders in process than of the backlog of finished goods in inventory.

Over the long run, the distributor may control delays associated with many of the flows from the producer to the retailer and consumer. In dealing with the flow of physical product, the distributor establishes the extent of time delays associated with filling orders and shipping product. In controlling the flow of funds through the distribution organization, he determines the extent of delays associated with billing and making payments.

The efficiency of the distributor or wholesaler as an information transfer agent may be considered to be a function of the delays and dissipation associated with this actor's response to the content of channels as discussed below.

As in the case of order filling, delays associated with responses to content are largely a function of administrative structure at the distributive level.

As we examine response functions at the distributive level, it will become apparent that, in the case of certain types of information flow, the delays inserted by the distributor are, for all practical purposes, infinite and the dissipation total.

Distributor responses may be conveniently categorized in terms of the source of channel content to which he is responding. The first class is content originated by the producer and includes policy information relating to pricing, distribution, credit, and ordering. The distributor's responses to this channel content are based largely on his evaluation of this information's present or future impact on his present mode of doing business.

A second class of information content relates to promotion. This includes information transmitted to the distributor directly, to the distributor and retailer through trade media, and to the distributor through consumer media. The distributor's responses to this class of information may be considered similar to his responses to policy information to the extent that the promotion is viewed as influencing his present or future sales position. In addition to this business oriented response, there is a second potential orientation toward promotional information which is not normally considered when evaluating the distributor's response to business oriented policy information. The distributor can also respond as a consumer in reacting to the appeals and product characteristic emphasis present in an ad. In developing representations of the distributor's response to communication, it will be necessary to determine whether or not these two types of responses are different and, if they are judged to be different, how they are to be distinguished.

A second class of distributor responses relates to channel content generated by retailers. This content is associated with present and expected sales based on present orders, existing inventories, pricing at the retail level, the retailer's enthusiasm for the product -- retailer selling effort, and the retailer's payments against invoices.

We have previously noted that several problems are inherent in the producer's attempts to transmit information to the retailer or consumer through the distributor as a transfer agent. In addition to delays and dissipation, which may be introduced at this level, the distributor is capable of modifying the existing channel content. He is not a passive element but an active one, and as such, is not apt to transfer information which he regards as contrary to his best interests. In the policy area he is apt to modify pricing, credit, or ordering policy

directives, either through explicitly changing the information content or, through statement of actions, indicating to the recipient of these communications that such policies are not to be taken seriously.

The distributor may also modify the content of formal communication channels with which he is associated. This modification may take the form of selective transmission of certain promotional pieces, and the exclusion of others. A good example of this type of selectivity is point-of-sale material, where large and bulky displays are less apt to reach the retailer than small pieces which can be easily carried.

We should also recognize that the distributor originates content for several channels of communication. Although promotional content may be generated at the distributor level, the information content produced at this point is more apt to be analogous to the policy information generated by the producer. Specifically, the distributor is concerned with and therefore generates content relating to the allocation and composition of his sales force, the compensation and motivation of the sales force, and special pricing deals designed to encourage the retailer to order more of a particular product.

In the preceding paragraphs we have briefly examined several factors which distinguish the wholesaler or distributor as a unique actor in the marketing environment. These defining characteristics of the distributor are summarized in the following specification.

Specification 5 -- Definition of the Distributor

- 1 - Flows Controlled
 - a - Finished Goods Shipments to Retailers
 - b - Promotional Communication to Retailers
 - c - Invoicing to Retailers
 - d - Payments to Producer

- 2 - Backlogs Controlled
 - a - Finished Goods Inventory
 - b - Orders in Process
 - c - Back Orders -- Unfilled Orders
- 3 - Delays Controlled
 - a - Filling Orders
 - b - Shipping
 - c - Billing
 - d - Payment
 - e - Ordering
 - f - Response Functions (as below)
- 4 - Responses to Channel Content
 - a - From Producers
 - 1 - Pricing Policy
 - 2 - Promotional Content
 - 3 - Credit Policy
 - 4 - Distribution Policies
 - 5 - Ordering Policies
 - b - From Retailers
 - 1 - Sales -- Orders
 - 2 - Pricing Actions
 - 3 - Selling Effort
 - 4 - Payments
 - 5 - Inventory Policies
- 5 - Modify Existing Channel Content
 - From Producer Regarding
 - a - Pricing
 - b - Promotional Content
 - c - Credit Policy
 - d - Ordering Policy
- 6 - Originate Content for Channels Communicating
 - a - Allocation of Sales Force
 - b - Direct Compensation Schedule
 - c - Desired Composition of Selling Force
 - d - Special Incentives to Increase Order Levels

c. The Salesman at the Distributor or Manufacturer Level

In this section we will consider the role of the salesman as an actor in the marketing environment and specify those actions of the salesman which concern us. The salesman working for the distributor or manufacturer will be considered as separate and distinct from the retail salesman dealing with the consumer. For our purposes, the distributor or manufacturer's salesman is largely an order

taker. Although he may perform other functions, the occurrence of such actions will be limited.

There are, obviously, good salesmen and bad salesmen, salesmen who continually bring in orders and salesmen who never seem to get any orders. Good salesmen are always in demand and management is frequently concerned with those factors which cause a salesman to change from one employer to another..

In terms of our basic structure the salesman controls only one flow -- that of orders. We should note that he may also control the flow of certain promotional communications. However, as indicated above, for the salesman working at the distributor or manufacturer level, we will consider this control to be of, at best, secondary importance.

The salesman also controls backlogs of unprocessed orders and, if his product is sampled, backlogs of samples and promotional materials.

As in other situations which we have considered, delays may be associated with the maintenance of backlogs, and we would expect the salesman to control the extent of the delays associated with his processing of orders. The salesman also controls, whether consciously or unconsciously, the delays associated with his response functions as outlined below.

For purposes of analyzing the responses of a salesman, we will consider a man in the employ of a distributor. Such a salesman responds to channel content generated by the distributor for whom he is working, the retailer whom he is attempting to sell, and the producer who makes the product which he carries.

The salesman, whether working for the distributor or manufacturer, is also a consumer and, as such, responds to the promotional content generated by the producer.

The salesman, whether working for the distributor or manufacturer, is also a consumer and, as such, responds to the promotional content generated by the producer.

Whether working for the manufacturer or the distributor, the salesman is concerned with and responds to the compensation schedule and ordering policy implemented by his employer.

For his own purposes and in order to transmit information to his employer, the salesman is concerned with the sales, inventory situation, and relative selling effort in the retail outlets with which he deals.

Since the salesman is the individual who communicates with the retailer, the comments previously made with reference to policy modification at the distributor level are applicable to the salesman. Hence, both the distributor and salesman must be considered when attempting to evaluate the probable modification of this type of channel content.

In those instances where the producer is attempting to make use of distributor salesmen to transmit promotion to the retailer, total modification of intended channel content is often a result of lack of preparation, motivation, and interest on the part of the distributor salesman, who may have hundreds if not thousands of products to cover.

We have already noted that the salesman is a potential source of information for the retailer or manufacturer regarding the inventory and selling situation at the retail level. Since a salesman is often hesitant to transmit unpleasant information back to his employer, we should recognize that he is apt to modify the content of communication regarding the situation at the retail level. Although we shall consider this function as a modification of channel content generated by the retailer, it might equally well be considered as original content generation.

The characteristics specified for the salesman are appropriate for either an industrial or consumer product salesman, although the industrial salesman would have certain additional characteristics which we will note later.

Our basic definition of a salesman working for a distributor or manufacturer is summarized in Specification 6.

Specification 6 -- The Distributor or Manufacturer's Salesman

The Salesman

1 - Flows Controlled

- Orders
- Promotional Communication

2 - Backlogs Controlled

- Unprocessed Orders
- Samples, Promotional Material

3 - Delays Controlled

- Order Processing
- Response Related

4 - Responses to Channel Content

- From Producer
 - Promotional Content
 - Direct Compensation Schedule (If Applicable)
 - Ordering Policy (If Applicable)
- From Distributor
 - Promotional Content
 - Direct Compensation Schedule (If Applicable)
 - Ordering Policy (If Applicable)
- From Retailer
 - Sales
 - Inventory Situation
 - Selling Effort

5 - Modifies Content of Channels Communication

- a - From the Manufacturer or Distributor to the Retailer
 - Ordering Policies
 - Promotion
- b - From the Retailer to the Manufacturer or Distributor
 - Selling Effort
 - Inventory and Sales Conditions

d. The Retailer

Since the retailer, like the distributor, is an integral part of the distribution chain through which physical product moves from the manufacturer to the consumer the two actors have some characteristics in common.

In the case of the retailer we will combine the administrative and selling functions and consider a single actor "the retailer" who is probably best exemplified by the one-man proprietorship in which a single owner, businessman, salesman takes orders, maintains inventory, handles promotion, and does the selling. This example clearly is not representative of the large department store in which administration, buying, promotion, and selling are clearly distinguished functions handled by different people in totally distinct departments. However, since the specific organization of these functions is performed differently within each outlet and we are interested in what is done without being particularly concerned about who does what within the outlet, we will consider the retailer as a single entity.

The retailer controls four basic types of flows. He determines the rate at which goods will be shipped to consumers and the rate at which orders will be sent to the distributor or manufacturer from whom he is purchasing. He, of course, determines the handling of financial relationships with the distributor or manufacturer and specifically generates payments to them for product received.

The retailer controls three types of promotional communication. First, he controls the flow of promotional communication at a personal level. In our simple model, this single retailer, proprietor, businessman, salesman is the individual who is in contact with the consumer.

Point-of-sale communication is also controlled by the retailer in that he determines whether or not a particular point-of-sale display will be placed in

his store. We have already noted that the distributor and his salesmen may influence this type of communication by delaying or not transmitting the material supplied by the manufacturer. However, once the material is transmitted to the store, it is the retailer who determines not only whether or not the display will be placed and maintained, but the location and hence the prominence of the display.

The retailer may also generate formal local media promotion. This promotion may take the form of direct transmittal of information prepared by the manufacturer (newspaper mats, and pre-recorded radio and television spots) or original content generated by the retailer himself. In any event, the flow of this information is under the direct control of the retailer and it is he who determines whether or not local tie-in with national promotion will be achieved.

The retailer controls two basic backlogs which greatly influence the manufacturer and distributor's expectations and performance. These are the inventory of physical product and the backlog of orders. As we examine alternative formulations of the ordering function, it will become evident that the retailer's handling of inventory stocking can greatly exaggerate or damp the actual trend of retail sales. The retailer's maintenance of back orders and the efficiency with which he handles them may have a large impact on the consumer's willingness to wait for a product by a particular manufacturer, rather than buy a competitive brand.

Three major delays are controlled by the retailer. These are the delay in processing and handling orders, the delay in making payments for goods received, and the delays associated with the response functions outlined below.

The retailer receives and responds to information from the producer, the distributor, and the distributor or manufacturer salesman. He also receives information from the consumer, and is in a unique position to monitor and respond to consumer reactions.

The retailer's response to information from the producer and/or distributor does not involve any new concepts or classes of content. He will respond to promotion generated at both levels and to pricing, ordering, credit, and compensation policies. In dealing with the manufacturer or distributor's salesman, he will respond to promotion, if any, generated by this source, and to the salesman's presentation of existing ordering and pricing policies.

In dealing with the consumer the retailer has an opportunity to respond to three new types of information content. These are (1) consumer preferences, (2) consumer purchases, and (3) consumer reports of responses to point-of-sale and media promotion. This third type of communication involves the most elusive communication content with which we must deal in attempting to describe the consumer marketing environment.

Since the retailer, in his capacity as a salesman, is in direct contact with the consumer, he is the transfer agent for all promotion directed to the consumer at point of purchase or otherwise conveyed through the trade channels. The retailer is thus in a position to modify or totally ignore channel content generated by the producer, the distributor, and the salesman.

The retailer may originate channel content directed to the consumer and other actors in the environment. Much of consumer oriented communication is based on materials supplied by the manufacturer. However, the retailer may generate his own consumer oriented communication content relating to a particular product or, more likely, directed toward establishing an image for his outlet. In this context the retailer may attempt to make use of a particular brand, either as a price leader or as an image builder.

The content of the retailer communication with the other actors in the marketing environment is most apt to relate to the state of his operations. Such

communication may take the form of highly formalized reports, such as orders or requests to return merchandise, indicating success and failure to sell respectively, requests for change in policy, or indications of reaction to competitive conditions and appraisal of the general business climate. The retailer is a businessman whose major motivations are economic, but he is also a consumer who is exposed to all of the influences which affect consumer image formation, particularly media advertising and word-of-mouth discussion. It is often difficult to determine the extent to which channel content originated by the retailer is based on a "rational" businessman's evaluation, rather than an "irrational" or "emotional" consumer response pattern. Clearly, we must be able to deal with both.

We are now in a position to summarize the basic characteristics of the retailer in terms of the six classes of behavior adopted as an analytical structure.

Specification 7 -- Definition of the Retailer

The Retailer

- 1 - Controls Flow of
 - Shipments to Consumers
 - Promotional Communication to Consumer
 - through Salesman Contact
 - through Point-of-Sale
 - through Media Promotion
 - Payments to Producer or Distributor
 - Orders to Producer or Distributor
- 2 - Controls Backlogs of
 - Inventory of Product
 - Back Orders
- 3 - Controls Delays Associated With
 - Payments
 - Ordering
 - Response Functions as Follows

- 4 - Responds to Channel Content
 - From Producer
 - Promotional Content
 - Pricing Policy (If Applicable)
 - Ordering Policy (If Applicable)
 - Credit Policy (If Applicable)
 - Direct Compensation (If Applicable)
- 5 - Modifies Existing Channel Content Relating to Promotion
 - From Producer
 - From Distributor
 - From Salesman
- 6 - Originates Channel Content
 - Directed to Consumer
 - Based on Manufacturer or Distributor Supplied Material
 - Based on Own Generation
 - Directed to Trade
 - Formal Order-Inventory Based
 - Informal-Response Based

e. The Consumer

We turn now to the end point of our entire marketing system, the consumer. The consumer controls only one rate of flow, only one backlog, and only one delay relevant to the marketing questions with which we are concerned. However, that one element is, in final analysis, as important as any or all of the many elements controlled by the other actors. For this reason, we will spend substantial time in examining the behavior of the consumer, and give careful attention to the description of his limited but crucial contribution to the activity of the marketing system.

The single flow controlled by the consumer is that of physical product. The consumer controls purchases.

The single backlog is that which results from his purchases -- namely, the backlog or inventory of product which he maintains. In the case of certain regularly consumed items, this may be a large inventory equivalent to several weeks of consumption. In the case of capital goods, it becomes an almost meaningless concept since the total "inventory" consists of one item which will

be used and maintained over a period of many years.

The delay controlled by the consumer is that associated with the purchase process. Viewed in the time domain, this is the time lapse between purchases which, as noted above, may range from a few days to several years. This delay may, of course, be viewed in the frequency domain rather than in the time domain, in which case it is the frequency of purchase of the product by the consumer.

Although the consumer's limited control of flows, backlogs, and delays may make him appear to be a relatively simple actor, the complexity of his response capability more than compensates for the apparent simplicity of his control functions. Not only are consumer responses varied and complex, but an attempt to describe the relationship of these responses to the consumer's exercise of his simple control over physical product movement raises problems and questions which were non-existent in the case of the distributor, salesman, and retailer.

Consumer responses to channel content can be analyzed in much the same manner as the responses of other actors within the system. We can categorize the source of channel content to which the consumer is responding in terms of its point of origination. In short, the consumer responds to channel content originated by the producer, the retailer, and other consumers.

From the producer the consumer receives promotion. As has already been noted, this promotion may be described in terms of its relation to "product characteristics" and "appeals".

The consumer receives similar information from a retailer. We must endeavor to describe the content of communication between retailer and consumer by relating it to specific product characteristics and appeals relevant to the purchase and/or use of the product. The consumer's communication with other

consumers, which we will refer to as word-of-mouth communication, may be considered analogous to the media communication between the producer or retailer and the consumer with the exception that word-of-mouth communication is bilateral and the same individual may, in the course of a single interchange, be both the originator and the recipient of communication. He may also provide information to the retailer with whom he has contact and, through participation in market research activities, provide information to the manufacturer.

The defining attributes of the consumer are summarized in Specification 8 - Definition of the Consumer.

Specification 8 -- Definition of the Consumer

The consumer is an active element which:

- 1 - Controls Flow of Purchases
- 2 - Controls Backlog of Product in Home
- 3 - Controls Delay-Associated with Purchase Process
- 4 - Responds to Channel Content
 - From Producer
 - Promotion Relating to Product Characteristics
 - Promotion Relating to Appeals
 - From Retailer
 - Promotion Relating to Product Characteristics
 - From Other Consumers
 - Relating to Product Characteristics
 - Relating to Appeals
- 5 - Originates Content for Channels Communicating
 - Product Performance
 - Product Appeals
 - Brand Quality

A Generalized Model of the Consumer

A. E. Amstutz
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In this section we will examine certain aspects of consumer behavior which, on the basis of theory and observation, appear to be appropriate for inclusion in a model designed to describe consumer behavior.

A Model and Its Function

This model is based on a cell structure in which each individual consumer or consumer type is represented explicitly by a single logical cell in the computer. The greater the diversity of the consumer population to be examined -- the greater the number of differentiating attributes to be encompassed by the model -- the greater the number of cells -- consumers -- required within the structure of the model.

The choice of a cell model constitutes a key structural decision. As a result of the cell structure, individual representative household units will be maintained as independent and unaggregated entities throughout the processing of the model. The individual cell or household will be the micro building block of this simulation. Through examination of a particular cell it will be possible to determine the status of a particular type of consumer at a given point in time and to examine the implications of alternative formulations of behavioral assumptions as the simulated consumer experiences, reacts to, and takes action in varied sequences of marketing situations.

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The specific cell model discussed here has many limitations which are, however, consistent with the objectives summarized below. By making explicit the limits and boundaries of the model the potential dangers of attributing to the model scope or coverage which it does not possess are minimized. As long as the objectives for which a model is designed are kept clearly in focus, limitations introduced by simplifying assumptions can be judged as reasonable or unreasonable.

It is impossible to conceive of a model which is not limited in scope and coverage. Any model, regardless of breadth or detail, is structured to function in a particular context -- to serve specified ends and achieve certain objectives. The validity of limiting or simplifying assumptions which narrow the scope or detail of a particular model can only be evaluated in context of the objectives which the model was designed to achieve. A model may be generalized -- designed to encompass factors common to several sub classes of behavior -- or highly specific -- designed to represent those factors unique to a particular situation at a given point in time. In either event the appropriateness of the representations embodied in the model cannot be assessed without referencing both that which the system purports to model and the use for which it is intended.

This model was designed to serve first as a tool of analysis and research to be used to achieve a better understanding of the underlying structure of a dynamic consumer product market. Second, it was designed to provide an artificial but realistic environment in which students studying marketing could operate simulated companies under conditions approaching those encountered in a real world situation. Before discussing this model, it may be useful to review the criteria which governed its development.

As indicated above, this model was developed as a tool for education and research. Its major research function was to provide a framework within which the implications of various formulations representing detailed consumer behavior could be examined. In the educational context it was intended to serve as a detailed representation of interactions within the consumer sector which influence the outcome of policies formulated by marketing management. The richness of the model was to be sufficient to permit simulation of all basic forms of market research so that the student manager working in the simulated environment of the model could gain facility in utilizing the same tools of research which are applicable to the investigation of comparable phenomena in a real world situation.

Portrait of a Consumer

The myriad of market research studies undertaken in an effort to describe consumers suggest literally hundreds of factors which at least one person has at one time considered as a meaningful descriptor of a consumer.

There are those concerned with the consumer as a rational economic planner who forms expectations, weighs relative utilities, and budgets available funds to achieve desired ends in a continuing and dynamic process of utility satisfaction, or optimization. Others have chosen to focus on apparently whimsical aspects of consumer behavior in an effort to describe factors influencing impulse purchases. Others have chosen to explore the alleged depths of the subconscious where in a symbolic world of Rorschach and TAT projections the consumer responds to the symbolism of advertising and displaces and satisfies basic drives through product use.

For purposes of this analysis we propose to describe the individual consumer

or consumer population through the use of two categories of descriptors. The first class of descriptors catalogues the consumer while the second class is concerned with what he does.

The first category of descriptors includes the normal classification measures: geographic location, age, family size, income and net worth of the purchasing unit, product ownership by the purchasing unit, and other census based statistics. This category also encompasses descriptors relating to the availability of information to the consuming unit -- availability of media, product availability in store or in use, probability of exposure to those selling the product, and potential exposure to those who have used a particular product or formed opinions about the product. This first class of descriptors must also include the content of a consumer's thoughts. This content description may relate to factual information which the consumer has obtained, or to his attitudes, likes and dislikes, preferences and aversions.

Our second main category -- that which the consumer does -- includes two types of actions, or if you prefer, one class of actions and one class of reactions. The first sub-category includes overt actions taken by the consumer -- directly observable results of specific decisions. This includes the consumer's decision to shop, in the sense of a conscious decision to go to a particular store in search of a given product or brand. A second example in this class is the decision to purchase a particular size, shape, color, model, and brand of a given product. A third example is the decision to talk about a product to another person, a decision which is manifest in the consumer's action of originating or participating in discussion concerning a particular product. A fourth example is present as a sub-set of the third. The consumer makes a "decision" to say

something in particular about the product when he talks -- he makes a decision to generate a specific content for his word-of-mouth communications.

The second class of consumer actions or reactions relates to the consumer's response to a variety of stimuli. For purposes of this discussion it may be helpful to consider these responses in terms of the stimuli eliciting them.

In the most basic sense we are concerned with responses to information and to product. As noted earlier, information can be communicated to the consumer through a number of channels. These include: formal media advertising, salesman communication, word-of-mouth discussion, and point-of-sale promotional material. Response to the product may occur as a result of exposure to the product on display at point of purchase, in the possession of another consumer, or in actual use.

In previous discussions of response to information and product, we have hypothesized three levels of reaction. The lowest impact level has been described as exposure and equated to contact with the medium of information transmittal or the product. The second impact level has been described as "noting" and defined in terms of a specified level of recall of communication content or product. The highest level of impact has been equated to orientation change defined in terms of a measurable change in awareness of or attitudes about the communication content or the product.

Consumer Characteristics

The factors chosen as descriptors of the consumer population are of paramount importance. The attributes selected as relevant descriptors will not only be the focus of this model; they will totally determine that which is a consumer for purposes of this discussion. If a potentially recognizable characteristic is not explicitly included as an attribute according to which consumer cells are

stratified it is, by definition, totally irrelevant as a determinant of consumer behavior within the structure of this model.

We might begin our consideration of consumer characteristics by specifying the location of the simulation population. In a highly simplified model we might be concerned only with consumers who reside in the same geographic region. For purposes of such a model, all consumers might as well be next door neighbors. Geographic location would simply not be considered in analyzing behavior within such a model. Would such a formulation be reasonable in light of our objectives? We need only to examine sales figures for products in different parts of the country to realize that substantial regional differences exist. To some extent these regional differences reflect variations in distribution channels, promotional facilities, and retail outlets. In this sense they are a manifestation of the space dimension. They are also a function of fundamental regional differences affecting the demand for specific products in particular parts of the country.

Since one of our objectives in developing this model is to achieve a realistic artificial environment in which the behavior of consumers in the simulated regions will correspond to that encountered in real world regional markets, geographic location will be maintained as a differentiating attribute. In formulating this model, we will establish 30 distinct geographic regions. If the parameters of this model are to be adjusted to correspond to a specific consumer product market, region dependent characteristics will require initialization to correspond to a particular region of the United States.

It is obviously important to differentiate these consumer units in terms of demographic characteristics which, according to our hypotheses, are

important as determinants of the consumer behavior to be studied.

In addition to recognizing regional differences it may be important to distinguish between rural, suburban, and metropolitan locations. The selection of such a breakdown is arbitrary, however, if we believe that information or product availability or consumer needs differ significantly between locations defined in these terms, it may be worthwhile examining census documents to insure that the distribution of this demographic characteristic within each simulated geographic region approximates the distribution of this characteristic in a corresponding geographic region of the country.

Thus far we have considered only two possible descriptors of a consumer population. In examining other attributes we will proceed more rapidly since our objective is to develop a model based on a reasonable set of assumptions rather than to consider every possible alternative set of characteristics.

Consumer income may be viewed as a basic indicator of the household's socio-economic status. However, specific products may dictate quite different income-based stratification. We would, for example, assume that the income stratification levels which would be relevant to luxury automobile marketing would be relatively inappropriate for a low priced food product. In addition to income, other factors may be considered as a basis for approximating the net worth of the household. In dealing with certain product classes a rent-own home measure may be important as a determinant of the consumer's need for a particular product.

It may also be desirable to classify consumers in terms of the media available to them. In a highly simplified model we might assume that one media channel was available for communication of advertising material and that

those consumers to whom this channel was available were automatically exposed to material placed in the channel. In this model, we will distinguish several media types and will therefore be concerned with the availability of media of each type to each consumer.

We may wish to establish a measure of consumer attitudes toward particular brands and/or products as a differentiating attribute. The basic problem with such stratification is in deciding how to describe and measure the attribute, "attitude". A simple binary like-dislike measure of consumer orientation toward a product might be adopted for this purpose or more elaborate orientation measures may seem appropriate. The determining consideration is how important one considers consumer attitudes to be. In this model extensive use will be made of an expanded orientation measure. The consumer's orientation toward particular characteristics of a product, the appeals used in a promotional campaign, the content of word-of-mouth communications, and salesman presentations will all be considered. In addition, our perception of consumer behavior is such that we will require an orientation measure sufficiently generalized to be used in representing consumer preferences for particular types of retailers and sufficiently sensitive to reflect changes in orientation as a result of exposure to promotion and product experience.

Actions Taken By the Consumer -- Decision Areas

In developing this model we will attempt to establish representation of the consumer behavior associated with decisions to shop in a particular store for a particular brand product; the decision to purchase a particular model-brand at a given point in time; and the decision to talk about a product.

In the simplest case we might consider modeling the market for a single model of a given brand of product. However, such a simplifying assumption

would delete all competitive considerations from our exploration of the market environment and render the model useless as a game environment. In developing our model we will therefore recognize the existence of multiple models of several brands of products.

Given competitive brands within the market, it will be necessary to describe differences between products. We will begin by relying on our previously discussed assumption that product can be described in terms of a limited number of product characteristics. The exact nature of these product characteristics will, of course, vary with the product under consideration, however, in keeping with our primary criteria of measurability, they must be objective product features which can be directly determined or assessed by a consumer panel.

In addition to objective product characteristics we will be concerned with appeals used by the manufacturer in promoting his product to the consumer. The use of the appeal and product characteristic categories will also be important in the context of advertising and communication content description and as such will enter into our formulation of information flow models.

Reactions -- Consumer Responses

Since an extensive media selection is to be available to the simulated consumer living in the environment of our model, it will be necessary to consider whether or not a particular consumer is exposed to a particular communication at a given point in time. The term "communication" refers to information transmittal via any media including media advertising on radio, TV, and in print, point-of-sale advertising, salesmens' communications, and word-of-mouth discussion between consumers. Each type of communication must be considered and functions representing the assumed and/or observed determinants

of exposure and response to each type of communication will require formulation.

A simulated consumer may be exposed to a particular brand and model of product in three contexts: (1) at point of purchase during a visit to the store; (2) in the possession of another consumer through interpersonal contact, and (3) through direct personal experience with product usage.

In keeping with our intention to provide a reasonable representation of basic market structure it will be necessary to take into account the existence of different types of retailers and their distribution throughout each of the geographic and area-type regions. Representation of the retail sector of the marketing system and development of models describing the actions and reactions of the retailers serving as intermediary between the distributor or manufacturer and the consumer is not part of our present objective. However, the supporting system necessary to permit the consumer to interact with the retailer must be created.

Formulations for a Generalized Consumer Model

In the preceding section the gross structural characteristics of a cellular model of a consumer population were outlined. The remaining sections will be devoted to a discussion of a generalized formulation for such a model. Specific parameter values have been applied to this generalized model to adapt it for use in specific product-market situations. However, for purposes of this discussion we will consider it only as a generalized structure.

Consumer Population Characteristics

An objective in developing this model of a consumer population was to create a relatively detailed representation of a consumer population divided into a sufficient number of differentiated areas to permit examination of regional markets and geographically dependent behavioral factors. The population in this model will be arbitrarily divided into 30 geographic areas and, within each geographic area, sub-divisions of rural, suburban, and metropolitan residence will be established.

Within each geographic region and residential sub-division, an appropriate set of consumer characteristics will be established for each consumer cell. The characteristics chosen for inclusion in this model may be summarized under the general headings

- (1) Demographic
- (2) Socio-economic
- (3) Behavioral
- (4) Psychological (attitudinal)

Demographic Characteristics

Other demographic factors in addition to the geography and location based considerations noted above may, in a particular product case, appear to be relevant as determinants of one or more aspects of consumer behavior. For purposes of this generalized formulation, we will attempt to focus on factors influencing a wide range of consumer actions under conditions associated with a variety of products. The age of the wage earner in each household is the one representative demographic characteristic in this category which is general enough to be applicable to a broad range of products and hence included in this formulation. Others which might be considered in formulating specific product models include marital status of head of household, family size, and

age and sex distribution of household members.

Socio-Economic Characteristics

This class of characteristics might, in a particular product case, include several indicators of the socio-economic standing of the household. For example, whether the home is rented or owned, the value or size of the home or apartment occupied, profession or occupation of head of household, education, religion, ethnic background, ownership of certain products, asset holdings, or leisure time pursuits might be regarded as appropriate descriptors in specific product cases. For purposes of this model, we will consider only the income of the household as a generally applicable first order index of socio-economic position.

Behavioral Characteristics

In a particular product case, this category might include measures of the frequency and extent of participation in any of thousands of activities relating to the need for or opportunity to use a given product. For purposes of this model, we will consider three characteristics in this category: (1) present product ownership (brand of product); (2) media habits as reflected in the availability (subscription or potential for exposure) of 36 media; and (3) retail store preference -- the frequency with which the household shops in various outlets.

Psychological (attitudinal) Characteristics

In the following sections of this chapter, we will be concerned with the development of models reflecting the consumer's response to experience with products, advertising, salesmen, and other consumers. In developing these models we will require a consistent means of representing two aspects of the consumer's orientation toward ideas and things. On the one hand, we will be concerned with the consumer's knowledge of the existence of a given brand or

about some aspect of a brand of product. The first attribute is knowledge in the basic sense of cognition or awareness.

Once we know whether or not the consumer is "aware" of a brand or some attribute of that brand, it is necessary for us to know what the consumer thinks about that which he knows. In this second context, we are concerned with whether or not he likes what he knows -- with his attitude toward a particular brand of product or toward a given product characteristic of that brand.

Our cognition or awareness variable might be defined as a level of saliency measure in which a maximum rating would be given that brand which was, so to speak, at the very top of the consumer's mind while the lowest or zero rating would be given to those brands of which the consumer was totally unaware.

The attitude variable must reflect degrees of liking and disliking from a maximum level indicating absolute preference through a neutral level to absolute abhorrence at the negative end of the scale.

The variables chosen for measuring attitude and awareness in context of these models are selected on largely empirical grounds. In this model, the orientation variables will be used as intermediaries linking manifestations of exposure to products or information to an ultimate decision to purchase. The variables chosen must therefore be operational in terms of three characteristics. First, they must be easily measured through the use of a simple objective test; second, they must provide a verifiable indication of consumer response to product and information exposure; and, third, they must provide a measure of the probability of consumer purchase.

For purposes of our discussion at this time, we will arbitrarily define these variables after noting that they have been operationally tested and found to be effective and valid as measures of those attributes which we are seeking to describe.

Definitions of Attitude and Awareness

"Awareness" is measured by asking the respondent "would you please name three different ... (makes of automobiles, brands of coffee, brands of toilet soap, etc.) Just name the first three that come to your mind."

In the aggregate population case, the percentage of respondents mentioning a brand is defined as that brand's awareness score. In the individual case, the first brand mentioned is defined as having an awareness score of 1, while all other brands are defined as having an awareness score of 0 in the mind of that consumer. Thus, at the individual level, a consumer is able to be "aware" of only one brand of product at a given point in time.

The attitude measurement is developed by showing the respondent an 11-point numerical scale ranging from -5 (dislike) to 0 (indifferent) to +5 (like) of the type illustrated previously. Upon being shown this scale, the respondent is instructed as follows:

"Will you please use this scale to tell me how you feel about a number of different things. Take baseball for instance. If you like baseball, give it one of the plus numbers. The more you like it, the bigger the plus number you should give it. If you dislike baseball, give it one of the minus numbers. The more you dislike baseball, the bigger the minus number you should give it. Now, what number would you give baseball, milk, toothaches, Ford automobiles, etc.?"

In the case of aggregate population measures the average of the ratings given a particular brand is defined as that brand's attitude score. In the individual case the attitude toward a particular brand is the response given under the circumstances described above.

In using the attitude scale to measure product characteristics, the question is modified to elicit the respondent's attitude toward various

characteristics of a particular type of product rather than brand of that product.

In the model developed in this chapter the attitude and awareness variables will be used to describe the consumer's orientation toward a given product characteristic, a given brand of product, and a particular retail outlet.

It should be noted that the measurement technique employed in defining the attitude and awareness variables is sufficiently general to facilitate use with any type of product. The technique has been successfully used in analyzing the market for appliances, food products, automobiles, special industrial training products, and drugs.

In using this technique in the context of this model, the major attributes of the product will be defined in terms of NP distinct product characteristics. Once this list of product characteristics has been established the attitude of each consumer toward each characteristic will be maintained as part of that consumer's file of distinguishing attributes.

The consumer's net attitude toward a given brand of product will be established as a function of attitudes maintained for the NP product characteristics. In final analysis, the brand attitude will emerge as a derived function of the attitude toward product characteristics and the promoted attributes of a particular brand. This formulation is discussed in detail later in this chapter.

The awareness variable will be employed in context of the model as a measure of the relative prominence of a particular brand in the mind of the simulated consumer. In this context, the awareness variable may be viewed as a manifestation of that brand which is at the "top" of the consumer's mind.

Variable Definition and Storage Allocation

Since this model is to be formulated in a manner appropriate for solution on a digital computer with binary storage capability, consideration must be given to the form of representation and the extent of storage required for each of the characteristics discussed above. The variable definition, form of representation, and storage requirement for each consumer unit is summarized by the table below. The characteristic is described under the heading CHARACTERISTIC. The combination of letters representing this characteristic in the computer model -- the variable definition -- is indicated under the heading VARIABLE. The column headed GRADATIONS specifies the number of degrees of differentiation used in scaling the variable. The column headed BITS REQUIRED indicates the number of binary bits of computer storage utilized in saving the information relating to that variable for each consumer unit.

<u>CHARACTERISTIC</u>	<u>VARIABLE</u>	<u>GRADATIONS</u>	<u>BITS REQUIRED</u>
Geographic Location	--	--	--
Rural, Urban, Suburban Classification	RUSID(c)	3	2
Age of Wage Earner	AGEID(c)	4	2
Income of Consumer Unit	INCOM(c)	6	3
Brand of Product Owned	PROWN(c)	1	B
Retail Store Preference	RETPR(r,c)	1	R
Media Availability (subscription	MEDAV(m,c)	1	M
Attitude Toward PC Product Characteristics	ATITD(pc,c)	7	3 * PC
Attitude Toward B Brands of Product	ATTBR(b,c)	7	3 * B
Attitude Toward R Retail Outlets	ATTRO(r,c)	7	3 * R
Awareness of B Brands of Product	AWARE(b,c)	1	B

Table 1 - Variable Definition and Storage Allocation

*Geographic location will be specified at a higher level than the consumer unit and is implicit in the consumer cell location. Explicit formulation of this factor at the cell level is therefore redundant.

Sample Formulations

The following sections focus on a series of models relating consumer characteristics summarized in Table 1 to the marketing environment and to the inputs supplied to that environment through M existing media by the producers of B brands of product, the R retail outlets, and the C-1 other consumers with whom a given consumer "c" might interact. Each of the models discussed below will be appropriate to all geographic sectors. In adapting a given model to a specific geographic location, consumer population parameters will be set in accordance with the distribution of population statistics in that region.

In developing sample models of individual behavior we will follow the outline of consumer actions and reactions summarized earlier. Specifically, we will begin with a model of the decision to shop and then proceed through action models describing the decision to purchase, the decision to talk about the product, and the determination of the content of word-of-mouth discussion. Formulation of reaction models will begin with a determination of the probability of exposure to communication. This will be followed by the probability of noting communication and determination of responses to a communication after that communication has been noted. A final model summarizes the effect of forgetting and conflict resolution.

AUG 2 1966
MAY 15 1967

MAY 23 1967,

OCT 2 1967

JAN 1 1968

MAY 8 '68

SEP 30 1968

SEP 10 1968

MAY 5

MAY 29 1968

BASEMENT

Date Due

OCT 16 '73

SEP 11 '73

APR 10 '78

SEP 15 '75

FEB 07 '80

JUL 12 '80

DEC 15 1986

JUL 10 1989

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